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Economically Important Plant Diversity along Selected Beach-sides of Central Kerala: Extending Cultivation to Beach-sides of Indian Peninsula

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Abstract

In order to evaluate the economically important plant diversity in the homesteads along the beaches of central Kerala, pilot field visits was conducted to eight beachesin order to select the beach sites with maximum cultivated plants in fishing folk settlements as well as naturally occurring vegetation in the beach area. Intense documentation was performed in three beach sites S1, S2 and S3 respectively. Field visits were carried out during December 2014 to March 2015 for plant collection and quadrat studies.A total Of 78 plants were recorded from the quadrat studies in the fisherman homesteads and beach sides of the three selected study area. S1 recorded a total of 42 plant species with *Cocosnucifera* having highest frequency and density whereas *Hibiscus rosa-sinensis*with highest abundance (7.33). S2 recorded a total of 53 species with *Ocimumtenuiflorum* having highest frequency and density whereas *Capsicum annum* with highest abundance (6.5). S3 recorded a total of 51 plants with highest frequency 60% for *Cocosnucifera*, *Ocimumtenuiflorum* with highest density (3.7) and *Capsicum annum* with highest abundance (9.25). The results obtained shows the suitability of the indigenous plants for plantation, cultivation and horticultural production in the beach sites for the future needs when land availability becomes an alarming problem in agriculture.

Introduction

Beach habitats serve as an ecological niche between terrestrial and marine realms, and form important nature conservation sites [1]. Coastal ecosystems include mangroves, mudflats, salt marshes, coral reefs, seagrass beds and lagoons, all of which are highly productive and support extensive fisheries and associated livelihoods. Traditionally, coastal areas have played an important role in the socio-economic development of the country primarily because seaborne trade remains the cheapest method of transporting large quantities of goods over long distances. Pressure on the coast has been increasing since the dawn of civilization [2]. A coastal forest is steadily encroached upon and replaced by a concrete jungle, thus altering long stretches of the coastline [3,4].

The higher number of coastal dune species along the west coast is attributed to larger and extensive sandy areas. The coastal sand dunes flora of India is under constant anthropogenic pressure due to rapid elimination of sand dunes and its associated vegetation [5]. The major source of sediments transported by longshore drift is rivers. Humans have simultaneously increased the sediment transport by global rivers through soil erosion (by 2.3 ± 0.6 billion metric tons per year), yet reduced the flux of sediment reaching the world's coasts (by 1.4 ± 0.3 billion metric tons per year) because of retention within reservoirs [6]. It is estimated that about 70 per cent of the world's sandy shorelines are eroding [7] and most of present day coastal erosion is likely to be driven by anthropogenic factors. Many of the coastal (open) spaces are assumed to be open access in nature and hence free-for-all, a plausible reason these spaces are under threat from new players in the coastal areas [8]. It is in this contest that the present study focuses on documenting the economically important plants grown by fishermen folk in the study area along with calculating ecological parameters such as frequency, density and abundance of cultivated plants in the study area in order to evaluate the acclimatized economic plants in the study area.

Materials and Methods

For the present study three-beach areas were identified after pilot field visits, which are located in central Kerala of Peninsular India. Data collection was performed in three beaches namely S1 - Azhikode (10°11'0"N 76°9'0"E) S2 - Cherai (10.1423° N, 76.1783° E) S3 - Edavanakadu (10° 0′ 54″ N, 76° 13′ 12″ E). Field visits were conducted during December 2014 to March 2015 for plant collection and quadrat studies, as the sea is relatively calm during the period. Data gathering using plant collection, identification and quadrat study was the basic method utilized. Area considered includes 50m from shoreline (from the point of origin of sand ridges). For laying quadrats $1m^2$meshes were used for herbaceous plant study and $10m^2$ quadrats were used for tree species. Data were gathered from Tsunami colony and local fishing folk inhabitants along the beach area. The important quantitative analysis such as density, frequency, and abundance of tree species, shrubs and herbs species were determined as per Curtis and McIntosh [9]. The plants listed were grouped according to the type of their uses into oil yielding plants, indigenously used medicinal plants, sugar yielding plants, fruit yielding plants, timber yielding species under-utilized trees, vegetable yielding plants and garden plants.

Results

In order to evaluate the plant diversity in the homesteads along the beaches of central Kerala, pilot field visits was conducted to eight beaches initially and extensive documentation was performed in three beaches namely S1 - Azhikodu, S2 - Cherai, S3 - Edavanakadu. Field visits were conducted during December 2014 to March 2015 for plant collection and quadrat studies.

A total of 78 plants were recorded from the quadrat studies in the homesteads and beach sides of the three selected study area. In order to ensure the ecological status of the plants, quadrate study was conducted in all selected beach area and the ecological parameters such as density and frequency for each species were performed. Table 1,Table 2 and Table 3 contains the details of plants documented with their scientific name, common name, frequency, density and abundance of plants at study area. Figure 1 to Figure 6 provides details on some plants from the homesteads of study area. A total of 78 plants were recorded from the quadrat studies in the fisherman homesteads and beach sides of the three selected study area. S1 recorded a total of 42 plant species with *Cocosnucifera* having highest frequency and density whereas *Hibiscus rosa-sinensis*with highest abundance (7.33). S2 recorded a total of 53 species with *Ocimumtenuiflorum* having highest frequency and density whereas *Capsicum annum* with highest abundance (6.5). S3 recorded a total of 51 plants with highest frequency 60% for *Cocosnucifera*, *Ocimumtenuiflorum* with highest density (3.7) and *Capsicum annum* with highest abundance (9.25). The results obtained shows the suitability of the indigenous plants for plantation, cultivation and horticultural production in the beach sites for the future needs when land availability becomes an alarming problem in agriculture.

Figure 1:*Tallinum sp.*- Ornamental plant

Figure 2:*Benincasahispida* - Vegetable

Figure 3:*Cocosnucifera* – Oil yielding

Figure 4:*Vincarosea* – Medicinal

Figure 5:*Cocciniagrandis*–Vegetable

Figure6: *Musa paradisiaca* – Fruit Yielding

Table 1: Quadrat study results of Azhikode Beach – (S1)

No	Species name	Common name	Qt 1	Qt 2	Qt 3	Qt 4	Qt 5	Qt 6	Qt 7	Qt 8	Qt 9	Qt 10	Frequency	Density	Abundance
1	*Cocosnucifera*	Coconut	5	2	2	1		6		1		7	70	2.4	3.42
2	*Hibiscus tiliaceous*	Thallipar uthi	9			6				7			30	2.2	7.33
3	*Terminaliac attapa*	Thallithe nga		2				2	2	8		2	50	1.6	3.2
4	*Ixoracoccine a*	Chethi		2	2		4						30	0.8	2.66
5	*Rosa chinensis*	Rose		1	1								20	0.2	1
6	*Mangiferain dica*	Mango		2		2				2		2	40	0.8	2
7	*Thespesiapo pulnea*	Pooparut hi		5								2	20	0.7	3.5
8	*Gliricidiasep ium*	Seemako nna	4		6					4			30	1.4	4.66
9	*Manilkaraza pota*	Sapota	1										10	0.1	1
10	*Plectranthus*	Panikoor		4	3				1				30	0.8	2.66

	amboinicus	kka													
11	*Hibiscus rosa-sinensis*	Chembaruthi		2	2	3	3	4					50	1.4	2.8
12	*Murrayakoenigii*	Karivepp u	1										10	0.1	1
13	*Azadirachtaindica*	Neem		1	2						1		30	0.4	1.33
14	*Casuarinalitorea*	Kattadi	2		3	2							30	0.7	2.33
15	*Anonnamuricata*	Sour sop			1					1			20	0.2	1
16	*Glochidionzeylanicum*	Nellikapulli									1		10	0.1	1
17	*Lawsoniainermis*	Mailanchi		1		3	2						30	0.6	2
19	*Jasminiumsambac*	Jasmine		2				2					20	0.4	2
20	*Anacardium occidentale*	Cashewnut					2	4	1			2	40	0.9	2.25
21	*Bougainvillea*	Bougainvillea				2							10	0.2	2
22	*Phyllanthusemblica*	Gooseberry		1									10	0.1	1
23	*Pimentadioica*	Sarvasugandhi		1									10	0.1	1
24	*Amaranthus blitum*	Amaranth			6								10	0.6	6
25	*Dendrobium sp.*	Orchid			1				1				20	0.2	1
26	*Impatiens balsaminia*	Balsam				3							10	0.3	3
27	*Emilia sonchifolia*	Muyalchvian								3			10	0.3	3
28	*Crossandrainfundibuliformis*	Kanakkambaram							3				10	0.3	3
29	*Aloe vera*	Aloe							2				10	0.2	2
30	*Ocimumtenuiflorum*	Thulasi							3	5	3		30	1.1	3.66
31	*Caricapapaya*	Papaya		2	2						2		30	0.6	2
32	*Solanummelongena*	Brinjal										2	10	0.2	2
33	*Psidiumguajava*	Guava		1									10	0.1	1
34	*Capsicum annuum*	Capsicum	2										10	0.2	2
36	*Vincarosea*	Savamnari							3				10	0.3	3
37	*Musa paradisiaca*	Plantain		4	4								20	0.8	4
38	*Passifloraedulis*	Passion fruit										1	10	0.1	1
39	*Swieteniamacrophylla*	Mahagani		1									10	0.1	1
40	*Tamarindusindica*	Tamarind		2									10	0.2	2

41	*Syzygiumlanceolatum*	Njaval				1							10	0.1	1
42	*Vitexnegundo*	Karinochi				1							10	0.1	1

Table 2: Quadrate study results of Cherai Beach – (S2)

No	Species name	Local name	Qt 1	Qt 2	Qt 3	Qt 4	Qt 5	Qt 6	Qt 7	Qt 8	Qt 9	Qt 10	Frequency	Density	Abundance
1	*Cocosnucifera*	Coconut							1				10	0.1	1
2	*Terminaliacattapa*	Thallithenga										1	10	0.1	1
3	*Ixoracoccinea*	Chethi		2	3		2	1	1				50	0.9	1.8
4	*Rosa chinensis*	Rose	1				4			2	1		40	0.8	2
5	*Mangiferaindica*	Mango					1		1				20	0.2	1
6	*Thespesiapopulnea*	Poopparuthi		1				2					20	0.3	1.5
7	*Gliricidasepium*	Seemakonna		4	3	2	4					7	50	2	5
8	*Manilkarazapota*	Sapota				1				1			20	0.2	1
9	*Hibiscus rosa-sinensis*	Chembaruthi	4				5	4	3		2	3	60	2.1	3.5
10	*Murrayakoenigii*	Karivepppu								2		2	20	0.4	2
11	*Glochidionzeylanicum*	Nellikapulli			2						3		20	0.5	2.5
12	*Jasminusambac*	Jasmine		2								2	20	0.4	2
13	*Bougainvillea spectabilis*	Bougainvillea									1		10	0.1	1
14	*Phyllanthusemblica*	Nelli									1		10	0.1	1
15	*Amarnthusbllitum*	Amaranth										8	10	0.8	8
16	*Impatiens balsamina*	Balsam										5	10	0.5	5
17	*Emilia sonchifolia*	Muyalchevian					4						10	0.4	4
18	*Ocimumtenuiflorum*	Thulasi	4	8	6			4	3	6	8	10	80	4.9	6.13
19	*Carica papaya*	Papaya				2	4				2	1	40	0.9	2.25
20	*Quisqualis sp.*	Akashamulla	2			2							20	0.4	2
21	*Allamadac*	Manjakol	5	7	8			2					40	2.2	5.5

	athartica	ambi													
22	*Gomphrena sp.*	Vadamalli			15						7		20	2.2	11
23	*Tabernum montana sp.*	Nandhyarvattam			3								10	0.3	3
24	*Psidiumguajava*	Guava			1			1	1			2	40	0.5	1.25
25	*Capsicum annuum*	Capsicum			3							10	20	1.3	6.5
26	*Tallinum sp.*	Pathumani	2			2							20	0.4	2
27	*Mirabilis jalapa*	4'O clock plant									2		10	0.2	2
28	*Syzygiumjambos*	Jambos					1				1		20	0.2	1
29	*Vincarosea*	Savamnarri			8			6	4		4	4	50	2.6	5.2
30	*Crysanthemum sp.*	Jamandhi							4				10	0.4	4
31	*Saccharum officinarum*	Cane sugar							5				10	0.5	5
32	*Capsicum frutescens*	Kanthari mullaku							2				10	0.2	.2
33	*Scropariadulcis*	kallurukki								3			10	0.3	2
34	*Tectonagrandis*	Teak								2			10	0.2	1
35	*Luffaacutangula*	Peechinga									1		10	0.1	1
36	*Citrus maxima*	Babloos									1		10	0.1	1
37	*Abelmoschusesculentas*	Ladies finger										4	10	0.4	2
38	*Averrhoabilimbi*	Chemmenpulli								2			10	0.2	1
39	*Pisuimsativum*	Cow pea										1	10	0.1	3
40	*Cucurbita maxima*	Matthanga					5					1	20	0.6	1
41	*Manihotesculenta*	Cassava										1	10	0.1	2
42	*Bauhinia variegata*	Mandaram										2	10	0.2	1
43	*Punicagranatum*	Pomegranate								1			10	0.1	6
44	*Musa paradisica*	Plantain			4		6	6	6	10		4	60	3.6	1
45	*Nerium oleander*	Arali		1									10	0.1	1
46	*Passiflorae dulis*	Passion fruit				1							10	0.1	4
47	*Tamarindusindicus*	Tamarind								1	1	1	30	0.3	1

48	*Vitexnegundo*	Karinochi	1										10	0.1	1
49	*Euphorbia sp.*	Bush plant	5										10	0.5	5
50	*Odinawodier*	Kalashu	1										10	0.1	1
51	*Albizialebbeck*	Vaka			1								10	0.1	1
52	*Cassia fistula*	kanikonna			1								10	0.1	1
53	*Centellaasiatica*	Kudavan				1							10	0.1	1

Table3: Quadrate Study results of Edavanakkadu Beach (S3)

No	Species name	Local name	Qt 1	Qt 2	Qt 3	Qt 4	Qt 5	Qt 6	Qt 7	Qt 8	Qt 9	Qt 10	Frequency	Density	Abundance
1	*Cocosnucifera*	Coconut	2	7	3	3	5					6	60	2	3.33
2	*Terminaliacattapa*	Thallithenga		2	2								20	0.4	2
3	*Ixoracoccinea*	Chethi	4				2		3		4		40	1.3	3.25
4	*Rosa chinensis*	Rose								2			10	0.2	2
5	*Mangiferaindica*	Mango			3	1	2						30	0.6	2
6	*Thespesiapopulnea*	Pooparuthi		10	5		5		4				40	2.4	6
7	*Gliricidasepium*	Seemakonna	6	4	4	6							40	2	5
8	*Hibiscus rosa-sinensis*	Chembaruthi			3		3		3				30	0.9	3
9	*Murrayakoenigii*	Kariveppu								1			10	0.1	1
10	*Glochidionzeylanicum*	Nellikapulli		1									10	0.1	1
11	*Jasminumsambac*	Jasmine		2			2				3		30	0.7	2.33
12	*Dendrobium sp.*	Orchid		2									10	0.2	2
13	*Amaranthusbllitum*	Amaranth		2				4					20	0.6	3
14	*Emilia sonchifolia*	Muyalcheviaan							7				10	0.7	7
15	*Ocimumtenuiflorum*	Thulasi	20					6		5	6		40	3.7	9.25
16	*Allamadacathartica*	Manjakolambi	3						3				20	0.6	3
17	*Gomphrena*	Vadamalli	5										10	0.5	5

	sp.														
18	*Tabernummontanasp*	Nandhyarvattam					1						10	0.1	1
19	*Capsicum annuum*	Capsicum	5							2			20	0.7	3.5
20	*Syzygiumjambos*	Jambos					1						10	0.1	1
21	*Vincarosea*	Savamnarri			6		4		2				30	1.2	4
22	*Chrysanthemum sp.*	Jamandhi										1	10	0.1	1
23	*Saccharumofficinarum*	Cane sugar								2			10	0.2	2
24	*Capsicum frutescens*	Kantharimullaku								2			10	0.2	2
25	*Luffaacutangula*	Peechinga			1		1						20	0.2	1
26	*Abelmoschus esculentas*	Ladies finger	4										10	0.4	4
27	*Areca catechu*	Arecanut	1		6								20	0.7	3.5
28	*Averrhoabilimbi*	Chemmenpulli					1			1			20	0.2	1
29	*Pisuim sativa*	Cow pea					2			3			20	0.5	2.5
30	*Cucurbita maxima*	Matthanga					1						10	0.1	1
31	*Bauhinia variegata*	Mandaram				2							10	0.2	2
32	*Punicagranatum*	Pomegranate					2			2			20	0.4	2
33	*Musa paradisiace*	Plantain			9		3		6				30	1.8	6
34	*Nerium oleander*	Arali			3					1			20	0.4	2
35	*Passifloraedulis*	Passion fruit							1				10	0.1	1
36	*Swieteniamacrophylla*	Mahagani					1			2		1	30	0.4	1.33
37	*Tamarindusindica*	Tamarind			1								10	0.1	1
38	*Syzygiumsp*	Njaval							1				10	0.1	1
39	*Vitexnegundo*	Karinochi					1						10	0.1	1
40	*Bambusabambos*	Bamboo		3									10	0.3	3
41	*Calophyllum inophyllum*	Punnamaram		1									10	0.1	1
42	*Casuarinaequisettifoila*	Chula maram		1		1							20	0.2	1
43	*Artocarpushirsutus*	Aanjili			1								10	0.1	1
44	*Benincasahispida*	Ash gourd			1								10	0.1	1
45	*Colocasia sp.*	Taro			4								10	0.4	4
46	*Eclipta alba*	Kaiyyunnyam					5			4		2	30	1.1	3.6

47	*Cocciniaindica*	Koval							1				10	0.1	1
48	*Artocarpusintegrifolia*	Jack tree							1	1			20	0.2	1
49	*Rhizophora sp.*	Kandal							8				10	0.8	8
50	*Leucasaspera*	Thumba								5			10	0.5	5
51	*Anthurium sp.*	Anthuriyam								1			10	0.1	1

Discussion

Based on the economic value of plants, data gathered in the present study from the three beaches S1, S2 and S3 are summarized and given in Table 4.

Table 4: Distribution pattern of economically important plant species in the study area

Economic Use	Species in S-1	Species in S-2	Species in S-3
Oil yielding	1	1	1
Medicinal plants	9	14	15
Vegetable yielding	3	6	7
Fruit yielding	12	0	8
Timber yielding	5	5	4
Ornamental	9	10	7

From the given Table 4 it is obvious that the beach sites under study recorded maximum diversity in medicinal plants and ornamental plants. The only oil yielding plant recorded is *Cocosnucifera*, which is the dominant tree species in all the study sites.*Ocimum sanctum* has maximum dominance in quadrat study as it may be a preferred plant with religious importance and also grown for its medicinal value. *Hibiscus rosa –sinensis* and *Musaparadisiaca* has the second largest frequency as it is a preferred garden plant and fruityieldingplant.These plants prove the plasticity to have abiotic stress resistance in the beach area.There is growing interest in planting and maintaining tree species by fishermen folk, which may be promoted in future.Promoting plantation of underutilized plants may be highly beneficial in reducing the carbon footprint and food footprint of indigenous people of the beachside.The increased plant cover and the diversity of plants can be attributed that the tsunami eroded and transported landwards-significant volumes of distinct black sands, rich in heavy minerals, from the shelf onto the beaches of the Kerala region after the 2004 incident of tsunami[10].However, the lives of most fishermen continue to be small scale: their socio-economic conditions continue to be characterized by uncertainty, poverty and conflicts; and there is an ever-growing pressure from external forces, which traditional villagers do not even know, let alone understand [8].

Conclusions

A clear conclusion that can be drawn from this study is that India's coastal areas (and hence the biodiversity that they contain) are challenged, due to very aggressive development and the indiscriminate construction of coastal structures. Through the present documentation study the economically important plants grown by fishermen folk in the study area along with calculating ecological parameters such as frequency, density and abundance of cultivated plants in the study area helps to evaluate the acclimatized economic plants in the study area. The sustainable existence of the local fishermen folk requires indigenous techniques for cultivation. The results rightly show the preference of plants for cultivation by the fisherman in the beach sideland of central Kerala.Results showa total of 78 plants in the fisherman homesteads and beach sides of the three selected study area.

S1 recorded a total of 42 plant species with *Cocosnucifera* having highest frequency and density whereas *Hibiscus rosa-sinensis*with highest abundance (7.33). S2 recorded a total of 53 species with *Ocimumtenuiflorum* having highest frequency and density whereas *Capsicum annum* with highest abundance (6.5). S3 recorded a total of 51 plants with highest frequency 60% for *Cocosnucifera*, *Ocimumtenuiflorum* with highest density (3.7) and *Capsicum annum* with highest abundance (9.25). The method used is purely reproducible one for the evaluation of beach side diversity and acclimatization in any area.

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